The Structural Diagnostic Toolset (TSDT)

Complete Formal, Theoretical, and Operational Engine Specification

Dean Tyldesley

Abstract

The Structural Diagnostic Toolset (TSDT) v1.0 is a closed, deterministic, domain-agnostic structural diagnostic engine. It unifies three formally defined divergence calculators, Agency Saturation, Coherence Stress, and Invariant Evaluation, under a single bounded stress functional while preserving each module's semantic identity.

This document specifies:
- The formal system definition
- The admissible divergence class
- Stress theorems
- Invariant dominance conditions
- Topological requirements
- Partition completeness
- Parameter identifiability
- Computability conditions
- Operational workflow
- Preset-specific diagnostic mappings

TSDT is classification-complete and structurally closed.

1. Formal System Definition

A system S is defined as:

$S = (X, C, I, R, D, K, \rho)$

Where:
X - Topological state space
$C \subseteq X$ - Closed constraint surface
$I \subseteq X$ - Closed invariant set
$R : X \to X$ - Transition relation (optional)
$D(x) \geq 0$ - Measurable divergence metric
$K \geq 0$ - Monotonic cumulative irreversible loss
$\rho > 0$ - Finite resolution capacity

2. Core Stress Functional
$\text{Stress}(x) = (D(x) + K) / \rho$
Irreversibility evolves as:
$K(t+1) = K(t) + \Delta K$, where $\Delta K \geq 0$

ρ remains fixed during evaluation horizon.

3. Admissible Divergence Class
Define admissible divergence space $\mathfrak{D}$ such that:
1. $D(x) \geq 0$
2. $D(x)$ measurable
3. ρ is defined as the supremum of admissible divergence over invariant-preserving states:
$\rho = \sup \{ D(x) \mid \exists\, x \in X \text{ such that } \chi_I(x) = 1 \}$
4. Scaling invariance holds:
If $D_2(x) = \alpha D_1(x)$, then $\rho_2 = \alpha \rho_1$

4. Invariant Dominance Rule
Define:
$\chi_I(x) = 1$ if $x \in I$, else 0

If $\chi_I(x) = 0 \to$ IMPOSSIBLE (IDENTITY LOSS)

Invariant violation supersedes stress evaluation.

5. Stress Partition Theorem
$S_{stable} = \{x \in X : Stress(x) < 1\}$
$S_{saturated} = \{x \in X : Stress(x) = 1\}$
$S_{collapse} = \{x \in X : Stress(x) > 1\}$
$S_{impossible} = X \setminus I$

These sets are mutually exclusive and collectively exhaustive.

6. Stress Admissibility Theorem
Given $D(x) \in \mathfrak{D}$, $K \geq 0$, and finite $\rho > 0$,
Stress(x) is finite, deterministic, and classification-complete.

7. Collapse Inevitability Theorem
If K(t) increases monotonically and is unbounded above, and ρ is finite, then $\exists\ T$ such that $Stress(x_T) > 1$.
Collapse becomes structurally inevitable.

8. Bounded Resolution Theorem
If $D(x) + K = \rho \rightarrow$ SATURATION.
Any further increase implies COLLAPSE.

9. Topological Conditions
Assume:
X is Hausdorff.
C and I are closed subsets.
D(x) measurable.

These ensure well-defined structural topology.

10. Parameter Identifiability Condition

Independent analysts must converge on estimates of $D(x)$, K, and ρ within bounded tolerances.

Failure of convergence renders the instantiation ill-defined.

11. Non-Vacuity Theorem

There exists at least one system where stable, saturation, and collapse states are non-empty.

Constructive example:

$X = \mathbb{R}_{\geq 0}$, $D(x) = x$, $K = 0$, $\rho = 1$.

12. Computability Condition

If $D(x)$ and K are computable in finite time and ρ is finite,
then classification executes in finite time.

13. Divergence Preset Definitions

Agency Preset:

$D(x) = \rho - \Lambda(x)$

Coherence Preset:

$D(x) = \Omega(x)$

Invariant Preset:

$D(x) = \Phi(x)$

Divergence must be computed according to its respective formal module paper.

14. Operational Workflow

1. Define system (X, C, I).

2. Select divergence preset.
3. Compute D(x).
4. Estimate K.
5. Determine ρ.
6. Verify invariant membership.
7. Compute Stress = (D + K) / ρ.
8. Apply preset-specific diagnostic mapping.

15. Preset-Specific Diagnostic Mapping

Agency Mode:
Stress < 1 → Agentic
Stress = 1 → Agency-Saturated
Stress > 1 → Agency-Collapsed
Invariant failure → Identity Loss

Coherence Mode:
Stress < 1 → Coherent
Stress = 1 → Meaning-Saturated
Stress > 1 → Coherence-Collapsed
Invariant failure → Identity Loss

Invariant Mode:
Stress < 1 → Admissible
Stress = 1 → Necessarily Transitional
Stress > 1 → Impossible

16. Output Specification

TSDT returns:
- Numeric Stress Value
- Preset-Specific Structural Diagnosis

TSDT does not predict behaviour, assign probabilities, recommend

interventions, or optimise systems.

17. Structural Closure Statement

Given admissible divergence, monotonic and potentially unbounded K, finite ρ, measurable topology, identifiable parameters, and computability conditions,
TSDT v1.0 constitutes a deterministic, non-vacuous, scale-consistent, computationally executable, classification-complete structural diagnostic engine.

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